

## Review of habilitation thesis

**Author:** Mgr. Jiří Mazurek, Ph.D.

**Title:** Advances in Pairwise Comparisons

**Reviewer:** doc. Mgr. Ing. František Zapletal, Ph.D.

The habilitation thesis with the title 'Advances in Pairwise Comparisons' focuses on the field of pairwise comparison matrices and their consistency. Without any doubt, the topic of the thesis fully suits the field of habilitation in Econometrics and Operations Research. It is worth noting that pairwise comparing is a cornerstone of (not only) multi-criteria decision making, with many issues constantly evolving by researchers. The chosen topic is still up to date with many possibilities for new insights.

The thesis was published by the renowned publisher Springer as a book. This fact is guarantee of quality itself. The text is written in English and is organised into 7 chapters. I appreciate that the length of the chapters is balanced with minimum redundancy. All chapters deal with the detection, evaluation or reduction of inconsistencies in the evaluation of experts. The author approaches the topic with carefully and systematically. As for the logical structure, I have no substantial problem with it. Maybe, I would rather put the chapter devoted to the ordinal consistency before the chapters with cardinal consistency (to go from general to specific), and in some chapters, I would rather present the axioms/properties for some measures, before the measures themselves are described. On the other hand, I understand why the author chose the presented organisation. Sometimes the author uses knowledge which is introduced in the following chapters (like in case of CR or KI measures (p. 12)). This can be quite confusing for readers who are not so experienced in the field.

Since I am not an English native speaker, I cannot judge the quality of the presented language in detail. Some formulations could have been a little bit straighter, but the text is quite easy to read (and understand). Of course, even here, some typos occur (like judgments, p. 49, or an additional dot behind (7.11)).

The book is full of math notations. Those are mostly provided in a comprehensible way. Only some inconsistencies appear in the text like:

- Italics for min and max operators, logarithm functions, modulo operation (what worse, sometimes the italics is used, sometimes not).
- The abbreviation s.t. (subject to) is not necessary to write in italics.
- Sometimes, the author uses double dots after min/max in the objective function of the optimisation models; sometimes not.
- Labels for the measures using 2 or more letters are written with a strangely large hspace (e.g., CR, MD, ...) in the formulas (not in the text).
- The number of missing elements in Chapt. 6 could be unified – (6.1) uses  $m_{i+1}$ , (6.5) uses  $\alpha$ , (6.7) uses  $S_i$ .
- The missing value is sometimes denoted using  $?$ , sometimes using  $'?$ ', sometimes  $"?"$  (moreover using the wrong style of apostrophes).

I appreciate very good work with the literature – the state of art analysis for all sections is worked out very carefully. Every chapter is accompanied with tens of references to high-quality sources, including those published by the author himself. In all chapters, the available options and approaches are mentioned and well discussed. I enjoy numerous comparisons of the approaches using the Monte Carlo simulation presented in the text and demonstration of the available SW tools. The results of the experiments are mostly nicely discussed (maybe, except for Sec. 2.5.6 where I miss it for the experiments with preference violation indices and in Sec. 5.3, Fig. 5.7).

In my opinion, the presented book is a unique publication putting together compendium of knowledge from the field of pairwise comparison matrices together with new useful experiments, summarising the well-established as well as the latest knowledge. What is important, the book is not only the compilation of the work of other authors but the high-quality papers published (or co-published) by the book's author are often cited too – his contribution to the researched field is undisputed (Mazurek et al.'s index for inconsistency reduction, derivation of weights from the matrices with incomplete information using spanning trees, many experiments with the existing indices and their visualization, etc). Of course, some minor comments and notes can be found, see the list below, however, I do think that those do not decrease the overall quality of the book.

In my opinion, the book meets all the required conditions for the habilitation thesis. The author proved his deep knowledge of the given field, his own contribution, and his ability to pass on the knowledge to the readers in a comprehensible way. My decision is supported also by his very good publication profile (including cooperation with highly respected researchers in the given field). Therefore, after the future successful defence of the thesis, I recommend awarding Mgr. Jiří Mazurek, Ph.D. with the title Associate professor ("docent").

#### Questions for the defence:

1. Can the author explain why the percentage of acceptable PC matrices increases with increasing  $n$ ? (This can be a bit counterintuitive).
2. I am interested in the author's opinion whether he thinks it is more appropriate to use rather iterative methods that do not require the decision maker's feedback, or some of the interactive methods, to solve practical examples.

#### The list of minor notes:

- I am not sure if all interested readers have knowledge of graph theory, thus it would be better to explain what the spanning tree is. (p. 11).
- P. 10: the author claims that (2.6) is equivalent to (2.7) – this would be worth either proof or citation.
- p. 22: I would not put notes into the captions (Tab. 3.1).
- p. 37: I do not understand why CI is identified as one of the least increasing indices, see Fig. 3.5 (despite being aware of different scales at vertical axes in Fig. 3.5 and 3.6).
- p. 39: I would prefer to unify the terminology in Secs. 3.3 and 3.4. and called all the properties either properties or axioms.
- p. 59: I do not understand why the steps are numbered beginning with 0 (unlike 4.3.2), especially since the beginning steps are more or less the same.
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- p. 89: Wouldn't be better to begin the Sec. 5.3 with the relationship between the coherence and the consistency? Moreover, I do not understand to a sudden switch from multiplicative PCM to additive ones.

In Ostrava, 30. 8. 2023

  
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